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A MEALY BUG, PHENACOCCLUS ACERIS SIGNORET, A NEW APPLE PEST IN NOVA SCOTIA

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During 1932 a species of mealy bug came into prominence in a few orchards in the Annapolis valley, more particularly at Lakeville and the district north of Berwick. The insect was less conspicuous in 1933, but in 1934 some severe infestations occurred. This mealy bug is scattered over the entire fruit growing area in Nova Scotia, and has probably been present for several years.

Specimens were forwarded to Ottawa in 1932 for identification and the following reply was received from Mr. J. J. DeGryse, of the Dominion Entomological Branch: "The species is *Phenacoccus aceris* Signoret. There is a record of a species of *Phenacoccus* known as *Phenacoccus dearnessi* described by King from Hawthorn. I think the latter is a synonym of *aceris*. So far as I know, the insect has been reported only once from Canada, that is to say in the above mentioned case. It is common in Europe and has been described under a great number of different names." From the foregoing, it is evident that the species is a new record as an apple pest in Canada.

In Europe, the insect is a very general feeder and a long list of food plants are recorded. Among the fruits are mentioned apple, pear, plum and cherry, as well as grape, gooseberry, currant, and blueberry. There is also a long list of other deciduous food plants, including most of our important forest trees and many of the smaller shrubs and ornamentals.

DAMAGE.

There is a secretion of honey-dew from this insect during the latter part of the season which becomes quite noticeable both on the foliage and fruit. The damage resulting from infestations is due to the growth of a sooty fungus on the surface of the fruit which has become moist with this secretion. In severe infestations such as occurred in a few orchards in 1932 and 1934, the entire fruit was blackened, affecting the skin to such an extent that it became roughened, the sooty coating being quite impossible of successful removal with any known agent.

Weather conditions have a marked effect upon the degree of discoloration of the fruit. The honey-dew is not noticeable until about mid-summer, and not secreted profusely until early autumn. If at this time rains or showers are frequent, the honey-dew is washed from the fruit, eliminating or greatly reducing the ill effects of the fungus.

Infestations of this insect have not been under observation a sufficient length of time in the Annapolis valley to determine if further ill effects are likely to follow. From repeated severe infestations, however, it would be reasonable to expect at least some loss of vigor in the host.

GENERAL LIFE-HISTORY.

The eggs are laid in masses, the larger number being found on the limbs, but they are deposited to some extent on the foliage, and petioles of the leaves. In 1933, egg-laying began on June 8 and ended on July 18, a period of 40 days. The average time taken by the females to lay the full complement of eggs was 15 days with a maximum of 21 days, and minimum of 6 days. The incubation period varied from 22 to 24 days. The first eggs deposited therefore, were about ready to hatch by the time the female had completed ovipositing, and there was a continuous daily emergence from each mass for a considerable period. In the orchard, hatching of eggs extended from July 2 to August 10.

The young nymphs upon emerging, crawl to the leaves where they start feeding, chiefly on the under surface. Near the end of August, the larger of the nymphs migrate from the foliage to fruit spurs and smaller limbs, where they pierce the bark and feed for a short time. In early September these migrants begin to spin small white fibrous cocoons for the winter. A few were observed feeding as late as October 20, but all had hibernated by November 1.

The location selected for hibernating is usually under rough bark on the larger limbs, in which situation the closely packed white cocoons are conspicuous.

The writer was unable to distinguish males from females in the nymphal stage. At hibernation, however, the males were mature and wintered as pupae in small white cocoons. The females did not mature but emerged in the following spring and fed for some time. They were observed in considerable numbers feeding on the fruit spurs as early as April 20. As oviposition did not begin until early June, the females had an extended period of development in the spring.

The male adult emerged from hibernation during May, with the maximum emergence about May 15.

ADULTS

The adult females are oval, soft-bodied insects, about 2.68 mm. long and 1.65 mm. wide. They are covered with a fine granular, white, waxy material. The body under this waxy covering is yellow or orange in color, but slowly darkens as egg laying proceeds and usually becomes brown or even blackish. Previous to ovipositing, the females spend several days producing a soft, white, cottony, fibrous material under which the eggs are deposited. As a rule the eggs are all deposited in one mass, but occasionally after laying a portion the female moves to a new position and repeats the whole process on a reduced scale. A small percentage of the females failed to oviposit, but these produced more of the waxy covering than those laying normally. Often these eggless masses were drawn out in a tortuous manner from one to one and one-half inches in length, the process finally exhausting the female. At death the bodies of many of these contained a small number of well developed eggs, but others contained none that could be distinguished.

The species is very prolific. There was an average of 542 eggs, maximum 939 and minimum 128 obtained from each of 42 females. The eggs were frequently not all expelled from the body for the female apparently became exhausted. An average of 53 eggs were thus retained by each female.

The male adults are smaller than the females. They hibernate as pupae during the winter in small white cocoons. These are much like the hibernating cocoons of the females, and found in a similar location on the trees. The male adults upon emerging in the spring, have a pair of delicate wings, although they were never observed to use them in flight, and two long white, waxy threads or filaments extending from the anal extremity. These thread-like appendages are longer than the body of the insect. The males are very delicate, frail creatures, many of which fail to completely emerge from the cocoons. The adults males do not feed and as far as could be noted, live but a short time. Mating was never observed.

EGGS.

The individual eggs are uniformly ovate in shape with one end slightly more rounded than the other. The average length of the egg is .327 mm. and width .168 mm. They are of a uniform yellow color.

The egg masses are from one-half to nearly an inch in length and when numerous are conspicuous on the trees. At first the eggs are laid in a rather compact mass but near the close of oviposition, they are more drawn out and mixed to a greater extent with the waxy fibers. It is not uncommon to find the last 30 or 40 eggs laid in an irregular line giving a chain effect.

NYMPHS.

The young mealy bugs when first hatched are very uniform in size with an average length of .411 mm. and width .185 mm. They are oval, flattened insects of a uniform pale yellow color, except the eyes which are dark red. There are two very short filaments at the caudal extremity.

There begins to appear over the body, shortly after hatching, a whitish, waxy, granular covering. This is more pronounced on the dorsal surface and at time of hibernation, the nymphs are usually well covered with this material.

The nymphs are slow moving and upon hatching wander to the nearest leaves where they insert their beak and feed chiefly from the under surface. Their movements are very restricted and it seems doubtful if feeding positions are changed more than a few times during the season. With beak inserted, they have the habit of elevating the abdomen almost vertically, but when disturbed quickly resume a flattened position. In the immature stages the sexes could not be distinguished and the female adults differ little from the nymphs except in size and abundance of the waxy covering.

HONEY DEW.

The nymphs secrete the honey-dew, which in turn is the cause of the sooty fungus on the fruit. The honey-dew is apparently colorless, slightly sticky and evidently secreted in such a manner as to become evenly distributed, for only rarely were very small droplets observed. It is not secreted, or at least not noticeably, when the nymphs are young. In late July, honey-dew was first noticed on foliage, but not until ten days later did it become profuse. About this time the black fungus made its appearance, first on the petioles and leaves, and soon after on the fruit, beginning near the stem end.

PARASITES AND PREDATORS.

A large six spotted lady-bird beetle was numerous in an infested orchard at Lakeville in 1933. When these were observed on May 3, the adult beetles

were very active and moved quickly over the limbs devouring the female mealy bugs in large numbers.

When examining hibernating material during the winter of 1932-33, the cocoons were found to contain a minute hymenopterous parasite. Some individual colonies were 75% to 85% parasitized, while few colonies showed less than 30% affected. In a heavily infested orchard at Lakeville, 58.5% of all hibernating mealy bugs were affected by this parasite. The adult parasites began to emerge at the insectary on July 10 and were numerous in orchards on July 19. The parasite was identified as an undescribed species of *Allotropa* pertaining to the family *Platygasteridae*. This parasite was general in all infested orchards examined during 1933.

CONTROL.

Mr. N. A. Patterson of the Annapolis Royal laboratory, has conducted a few field experiments for the purpose of obtaining information on control measures. However, the work done to date has not been at all extensive and the results obtained cannot be considered conclusive.

A certain measure of control was indicated, following the use of oil sprays in the delayed dormant period. Nicotine or summer oil sprays, applied to the under surface of the leaves, during the last week of July, apparently gave a good control of this insect.

SOME NEW NORTH AMERICAN SPECIES OF DELTOCEPHALOID LEAFHOPPERS

BY DWIGHT M. DELONG AND RALPH H. DAVIDSON,

Ohio State University, Columbus, Ohio.

Polyamia brevipennis n. sp.

Resembling *caperatus* in size and general appearance but without color markings, apparently more closely related to *apicatus* and *alboneura* but with short wings. Length 2-2.5 mm.

Vertex bluntly angled, a little longer on middle than basal width between eyes. Elytra short covering only first four or five basal segments of abdomen, apical cells very small.

Color straw yellow, frequently unmarked. Ocelli black. In dark specimens with faint markings on vertex. Four large brown spots on anterior margin of pronotum and veins of elytra heavily infuscated.

Genitalia: Female last ventral segment very short on lateral margins, then convexly rounded with a slight notch either side. Lateral portions of preceding segment conspicuously produced at either side. Male valve roundedly produced, twice as broad as long. Plates triangularly elongate, longer than combined basal width.

Described from a series of twenty specimens collected in Birmingham, Alabama, by the senior author June 16 and 17, 1928. Male holotype, female allotype and male and female paratypes in collection of the senior author.

These were collected in a very interesting habitat of short grasses along with *alboneura* and specimens of *Lonatura bicolor* and *L. notata*.

Polyamia similis n. sp.

Resembling *obtectus* in form and appearance but smaller with distinct male genitalia. Length 3 mm.

Vertex as in *obtectus*, bluntly angled, slightly wider between eyes than length at middle, equaling pronotum in length.

Color: The color pattern is almost like *obtectus*. Vertex with recurved arcs either side of apex. A pair of proximal spots at apex and one next each ocellus, a broken band between anterior margins of eyes and oblique markings either side on basal portion brown to black. Mottling on anterior margin of pronotum, brown. Wing veins rather heavily infuscated.

Genitalia: Last ventral segment arising from posterior margin of previous segment, produced rather abruptly to posterior margin which is trilobate. The central lobe is slightly broader and not quite as long as the lateral lobes. Lateral processes of preceding segment conspicuous at sides of last ventral segment. Male plates broad at base, short, triangular. One-third wider at base than long. Male oedagus frequently pulled out of genital chamber and lying dorsally. In this position with anterior end curving downwardly and with a basal spur on anterior ventral portion. Connectives very long.

Described from a large series of specimens from Clarksville, Tennessee. Collected by the senior author during June, July and August, 1915 and 1917. Also a series of specimens collected at Vienna, Illinois, during June, 1934, by Dr. H. H. Ross and the senior author. Male holotype, female allotype and paratypes in author's collection. Paratypes in Illinois Natural History Survey Collection.

This species has been confused with *obtectus* and *compactus*.

Polyamia algosus, n. sp.

Resembling *fumidus* in size and appearance but paler in color and with distinct genitalia. Length 4.5 mm.

Vertex bluntly angled, one-fourth wider between eyes than length at middle.

Color: Vertex pronotum and scutellum pale yellow tinged with gray. Eyes dark. Elytra whitish subhyaline, slightly smoky, abdomen showing conspicuously through elytra.

Genitalia: Female last ventral segment sloping from lateral angles to posterior margin which is roundly notched either side of a broad median tooth which is slightly indented at middle so as to form a pair of pointed teeth. Side portions of preceding segment conspicuous at lateral margins. Male valve very short and narrow, lying entirely within the concavity of the last ventral segment. Plates elongate, triangular, almost as long as combined basal width. Pygofers rather short and broad at tips.

Described from one male and three female specimens collected at Wisconsin Rapids, Wis., July 20-26, 1930. Male holotype, female allotype, and female paratypes in author's collection.

It differs from *fumidus* in having a definite tooth on the female segment and by the shorter male plates and the shorter, broader pygofers.

Hebecephalus obliqua n. sp.

Size and general appearance of *cruciatu*s but with distinct coloration and genitalia. Length 2.5-2.7 mm.

Vertex bluntly angled almost as long as basal width between eyes.

Color: Vertex with a pair of black triangular spots at apex. A broad

oblique band extending from ocellus to center of vertex either side of middle, a pair of pale oblique markings either side on posterior half. Pronotum dark with five pale longitudinal lines. Elytra milky white with veins heavily infuscated.

Genitalia: Female last ventral segment truncated, with central third produced to form a triangular tooth which is slightly bifid at apex. Lateral angles of last ventral segment rounded off. Male plates resembling *cruciatus*, as long as combined width at base. Apices broad, obliquely truncate, a black spot at center of each plate. Tips of pygofers with heavy spines bent inwardly. Male valve with apex broad, truncated.

Described from a series of seven specimens collected at Redfish Lake and Stanley Basin, Idaho, August 3, 1930, by the senior author. Holotype female, allotype male, and male and female paratypes in author's collection.

***Hebecephalus algidus* n. sp.**

Resembling *vinculatus* in size and coloration but with vertex a little more sharply angled and with distinct genitalia. Length 3.5 mm.

Vertex bluntly angled but appearing pointed, a little wider between eyes than median length.

Color: Vertex white with a pair of spots near apex and a spot next either eye, brown. Two pairs of faint transverse bars on posterior half. Pronotum pale. Elytra milky white marked by two rather distinct brown transverse bands. The anterior extends obliquely forward from the costa and crosses the middle of the clavus. The posterior one crosses the anterior portion of the apical cells. The veins are not infuscated and are scarcely visible except where they are crossed by these bands.

Genitalia: Female last ventral segment deeply narrowly notched either side of a pair of central proximal teeth which are straight and closely appressed on inner margins, broad at base and with outer margins convexly rounded to form rather sharp apices. Side portions of underlying segment conspicuously produced beyond last ventral segment.

Described from a single female specimen collected in Alaska in 1921. Holotype female in collection of senior author.

***Hebecephalus borealis* n. sp.**

Resembling *vinculatus* in form, coloration and general appearance but much larger and with distinct genitalia. Length 4 mm.

Vertex bluntly angled, one-fourth wider between eyes than length at middle.

Color very similar to *vinculatus*. A row of triangular spots above margin sometimes merged with first transverse bar. Pronotum rather heavily marked with dark brown. Veins of elytra, rather uniformly and heavily infuscated, appearing slightly banded.

Genitalia: Female last ventral segment with prominent lateral angles, posterior margin rather deeply roundedly excavated either side of a pair of proximal median black teeth which are broad and with broadly rounded apices. Male valve broadly triangular. Plates short and broad, shorter than combined basal width, scarcely narrowed at apex which is obliquely cut off so that the outer margins are longer than the inner margins.

Described from one male and two female specimens collected at Nordegg,

Alberta, August 31, 1921. Male holotype, female allotype, and female paratype in collection of the senior author.

***Laevicephalus orientalis* n. sp.**

Resembling *uhleri* in form and appearance but with more sharply pointed vertex and distinct genitalia. Length 3.5-4 mm.

Vertex rather sharply angled as long or slightly longer on middle than basal width between eyes.

Color: Vertex creamy to bright yellow pronotum and scutellum greenish washed with yellow. Elytra varying in color, sometimes dark green with white or yellowish veins often with apices smoky. In case of the eastern Canadian or mountainous form, often with black elytra.

Genitalia: Female last ventral segment without lateral angles, sloping to middle of segment which is distinctly incised at middle leaving a pair of inconspicuous teeth at middle. The median two-thirds of posterior margin heavily black bordered. Male plates broad at base strongly convexly curved to rather blunt and broad apices. Pygofers greatly exceeding plates. Oedagus in lateral view appearing broad with a curved portion extending ventrally and posteriorly and produced by curving upwardly. This structure is open in the middle and appears as two parallel structures. In *uhleri* the terminal portion of the oedagus is pointed ventrally, widened dorsally and produced into two divergent pieces.

The male oedagus is quite different from *uhleri*. Whereas *uhleri* is a high altitude, western species, *orientalis* is an eastern form and may occur far north in Canada or in Southern Illinois, Tennessee, Pennsylvania, Virginia, D. C., and it apparently has a rather wide distribution. Described from a large series of specimens from Conewago, W. Chester, Kane and Greensburg, Pa., Fabyans N. H., Cranberry Lake, N. Y., Somerville, N. J., Ch. Bridge, Va., Saddleback Lake, Me., Sault Ste. Marie, Michigan, Lauzon, Que., and Eichorn, Shawneetown, Hardin, Elizabethtown, Hanging Rock and Cave In Rock, Illinois.

Holotype male and allotype female from Pennsylvania in author's collection. Paratypes in Herbert Osborn collection and the Illinois Natural History Survey collection.

***Laevicephalus rotundens* n. sp.**

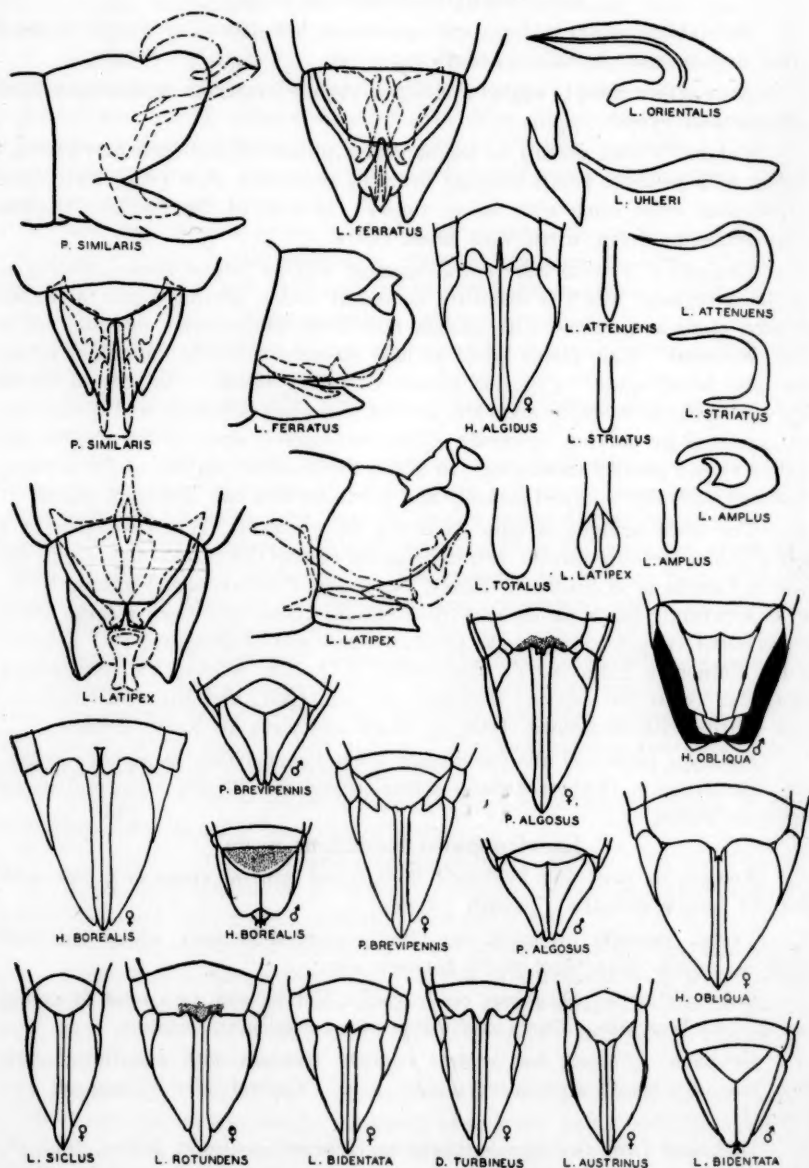
Resembling *acus* and *sylvestris* in size and general appearance but with different female genitalia. Length 3.5 mm.

Vertex strongly produced but bluntly pointed at apex, about one-fifth longer on middle than basal width between eyes.

Color yellow to pale green, ocelli black. Vertex with two faint diverging lines at apex brownish. Elytra subhyaline with conspicuous venation.

Genitalia: Female last ventral segment truncate with a definite notch either side of a rounded produced median tooth. Central third of segment embrowned.

Described from two female specimens collected at Orono, Maine, June 18, 1913, and August 1, 1913, and one female from Ft. Kent, August 28, 1913, by Professor Herbert Osborn. Female holotype and female paratype in Osborn Collection.



AMERICAN DELTOCEPHALOID LEAFHOPPERS

***Laevicephalus siclus* n. sp.**

Resembling *convergens* in general form and coloration but with different female genitalia. Length 3.5 mm.

Vertex pointed but with blunt tip, a little wider between eyes than length at middle.

Color: Vertex yellowish marked by a pair of rather broad brownish lines which arise at the apex extending along margin of vertex almost to ocellus then extending across either side of vertex almost to anterior margin of pronotum. Pronotum pale washed with yellow, disc darker. Elytra whitish subhyaline veins yellowish green.

Genitalia: Female last ventral segment broadly convexly rounded, without prominent lateral angles.

Described from two female specimens collected at Murtaugh, Idaho, June 21, 1930, by the senior author, a female specimen from Ft. Pierre, S. D., Sept. 21, 1920, by H. C. Séverin and one female from Richfield, Utah, collected Sept. 20, 1927.

Female holotype and female paratypes in collection of senior author.

***Laevicephalus austrinus* n. sp.**

Resembling *siclus* but larger, more robust and without color markings. Length 4 mm.

Vertex bluntly angled, length at middle equalling basal width between eyes.

Color: Vertex yellowish, a faint brownish line extending from apex either side to ocellus. Pronotum and scutellum yellowish. Elytra greenish subhyaline, veins yellow.

Genitalia: Female last ventral segment with lateral angles rounded, median two-thirds rather abruptly and strongly produced more than one-third its length and convexly rounded. The margin slightly indented so as to appear trilobate.

Described from a single female specimen from Texas without specific locality. Female holotype in collection of senior author.

***Laevicephalus bidentata* n. sp.**

Resembling *collinus* in general appearance but with distinct genitalia. Length 4 mm.

Vertex bluntly angled, one-fourth wider between eyes than length at middle. Elytra shorter than abdomen, exposing its apical portion.

Color: Yellow unmarked, ocelli black. Teeth of last ventral segment usually brown.

Genitalia: Female last ventral segment with produced lateral angles, posterior margin shallowly concavely excavated either side of a broad median produced portion which is incised at center forming two distinct brown teeth which are produced beyond the lateral angles. Male plates as long as combined width at base. Broad at base gradually sloping to blunt rounded apices. Pygofers exceeding plates.

Described from two female and two male specimens collected at Pingree Park, Colorado, August 20, 1929, by Prof. J. G. Sanders. Female holotype, male allotype and male and female paratypes in collection of senior author.

***Laevicephalus ferratus* n. sp.**

Resembling *striatus* in form and appearance, distinguished only by the unique character of the genitalia. Length 3.5 mm.

Vertex bluntly angled, one-fourth wider between eyes than length at middle.

Color yellow washed with green, veins of elytra yellow.

Genitalia: Female segment shallowly concavely rounded as in *striatus*. Male plates scarcely exceeding valve, very similar to *striatus*. Connective very short, in ventral view with a rounded horseshoe shaped base. Oedagus short, angularly bent and directed upward. Apex sharply pointed appearing bifurcate in dorsal view.

The oedagus and connective are remarkably different from *striatus*.

Described from one male and two female specimens collected at Presque Isle, Penna., by the senior author, July 21, 1920. Holotype male, allotype female and female paratype in author's collection.

***Laevicephalus attenuens* n. sp.**

In form and appearance resembling *striatus* but with distinct male genitalia. Length 3.5 mm.

Vertex bluntly angled, apex almost rounded, one-fourth wider between eyes than length at middle.

Color yellowish to green. Vertex with a pair of triangular spots just back of apex, a broken band between anterior margins of eyes and another one on posterior portion. Pronotum usually dark in color. Elytra with pale veins heavily infuscated.

Genitalia: Female last ventral segment truncate, slightly broadly produced either side of a broad shallow v-shaped notch at centre. Male valve and plates not different from *striatus*. Male oedagus longer than *striatus* tapering to fine attenuated apex. Normally extending dorsally then curved downward and forward forming an arched portion and with apex very delicate and curved dorsally so as to form a slight hook at apex.

Described from a series of male and female specimens collected at Yellowstone Park, Wyoming, July 4, 1930, by the senior author. Male holotype, female allotype, and male and female paratypes in author's collection.

***Laevicephalus latipex* n. sp.**

Resembling *striatus* in form and appearance, but with different color markings and distinct male genitalia. Length 3.7-4 mm.

Vertex bluntly angled, a little more than one-fourth wider between eyes than length at middle.

Color pale brown or green. Vertex with a pair of oblique dashes at apex extending along margin and another pair along margin just before ocelli. A pale interrupted band across vertex just back of these and oblique dashes of brown on posterior half. Elytra usually heavily infuscated.

Genitalia: Female last ventral segment shallowly concavely rounded. Male external genitalia not different from *striatus*. Male oedagus thick in lateral view and rather sharply curved back upon itself. In dorsal view with apex rather abruptly broadened to twice its width on apical third, formed by the dorsal portion of the oedagus tube curving outward as the oedagus is directed forward.

Described from a series of specimens collected at Pike's Peak, Colorado, June 23, 1919, by J. H. Pollock, specimens from Pingree Park, Colo., August 20, 1929, by J. G. Sanders, Estes Park, Colo., August 29, 1920, by H. C. Severin and at Lincoln and Omaha, Nebraska, June and July, 1932, by Dr. Dorothy M. Johnson. Male holotype, female allotype and male and female paratypes in author's collection, paratypes in collection of Dr. Johnson.

***Laevicephalus totalus* n. sp.**

Resembling *striatus* in form and appearance but with distinct male genitalia and usually distinctly marked. Length 3.7-4 mm.

Vertex bluntly angled more pointed than in *latipex*, almost as long on middle as basal width between eyes.

Color yellowish with variable markings. Vertex usually marked with brown so as to form a somewhat definite broad longitudinal stripe extending from apex to anterior margin of pronotum on either side. Pronotum with longitudinal stripes brownish. Elytra partially infuscated.

Genitalia: Female last ventral segment roundedly notched either side near lateral angles and broadly roundedly notched at center giving the margin a four-lobed appearance. Male valve and plates not different from *striatus*. Male oedagus shorter than in *striatus* in dorsal view appearing greatly flattened and several times as broad as *striatus* throughout its entire length.

Described from a large series of specimens from Murtaugh, Idaho, collected by the senior author, June 21, 1930, and a series of specimens in the Osborn collection from Cane Tree and Cattail Spring, Wyoming, collected in August and September 1909 and 1906. Holotype male, allotype female, and male and female paratypes in collection of senior author. Male and female paratypes in Osborn collection.

***Laevicephalus amplus* n. sp.**

Resembling *striatus* in form and general appearance but larger and with different coloration and distinct male genitalia. Length 3.7-4 mm.

Vertex bluntly angled, almost one-fourth wider between eyes than length at middle.

Color: Vertex yellowish, a pair of long heavy oblique dashes extending from apex along margin and a pair of linear spots just above ocelli, brown. Posterior portion of vertex with faint markings. Scutellum washed with yellow. Elytra with veins pale, heavily infuscated.

Genitalia: Female last ventral segment broadly concavely rounded. Male valve and plates not differing from *striatus*. Male oedagus short and broad, tubular in form with circular opening on dorsal surface but not broadened or enlarged at apex. The oedagus is much shorter and broader than *striatus*.

Described from a pair of specimens collected at Bakersfield, California, by Professor Herbert Osborn. Male holotype and female allotype in Osborn collection.

***Deltocephalus turbineus* n. sp.**

Resembling *fuscineruosus* in general form but with different coloration and distinct genitalia. Length 4 mm.

Vertex not strongly produced, bluntly angled, about one-third wider between eyes than median length.

Color: Pale brownish marked with dark brown. Vertex with a pair of faint spots just above apex, a darker pair next each ocellus, a narrow interrupted transverse band between ocelli and two oblique dashes either side on posterior portion brown. Pronotum dark brown marked with five pale longitudinal vittae. Elytra brownish, rather opaque, veins rather obscure. Second sector divided by two cross veins on anterior half.

Genitalia: Female last ventral segment with narrow lateral margins then sloping to posterior margin which is deeply notched so as to form three rather definite lobes which are angularly produced; the central one is longer and more narrow and appears as a broad tooth. Lateral portions of preceding segment conspicuous at lateral margins of last ventral segment.

Described from a single female specimen collected at Fowler, Colorado, June 9, 1904, by E. S. G. Titus. Holotype female in author's collection.

NOTES ON CANADIAN NOCTUIDS AND PYRALIDS WITH
DESCRIPTIONS OF NEW SPECIES (LEPIDOPTERA)*

BY J. MCDUNNOUGH,

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NOCTUIDAE.

Genus *Platypolia* Grt. (*Eurotype* Hamp.)

Under the present listing the genus includes the species *anceps* Steph. (*confragosa* Morr.) and *contadina* Sm.; however, on the strength of the similarity of male genitalia, I believe that *loda* Stkr. should be transferred here from the genus *Eumichtis* Hbn. The two last-named species form a group in which the male antennae are serrate and fasciculate in distinction to the pectinate antennae of the genotype, *anceps*. *Contadina* was described from a specimen from Victoria, B. C., and is easily separated from *loda* by the whitish thorax and strong white suffusion in basal and terminal areas of forewing, *loda* being a rather unicolorous dark blackish, except for the whitish crosslines and spots; it also occurs on Vancouver Island and in the interior of British Columbia. On male genital characters *contadina* is separated (among other things) by the presence of a strong spine near the apex of the juxta and a shorter lateral, subapical thorn on the aedeagus than that of *loda*. On working over some material from Lethbridge, Alta., recently I came across a male specimen which proved on genitalic characters to be referable to *contadina*, but which possessed the general facies of *loda*; on looking through the collection I discovered a second male specimen from Banff, Alta. (N. Sanson) which had come originally from the Wolley-Dod collection and had evidently caused him much difficulty in placing, judging by the various notes attached to the pin; this specimen is unfortunately without abdomen.

Both these specimens are smaller in size than either *contadina* or *loda*, wing-expanse being 40 mm.; from *contadina* they differ further in the evenly dark blackish color of the thoracic vestiture and a similar even coloration of the primaries the maculation (as in *contadina*) being rather dully marked in whitish. The secondaries are deep smoky, considerably darker than in *loda* males, with only a slight paling along outer margin, particularly at anal angle. Fringes smoky. Beneath rather evenly pale smoky, hindwings paler than primaries with a large

*Contribution from the Division of Systematic Entomology, Entomological Branch, Department of Agriculture, Ottawa.

dark discal dot, and faint traces of a postmedian line. For this apparently rare race I propose the name *CONTADINA* var. *ALBERTAE* n. var. the types being as follows:

Holotype—♂, Lethbridge, Alta., Sept. 7, 1932, (H. L. Seamans); No. 3869 in the Canadian National Collection, Ottawa.

Paratype—1 ♂, Banff, Alta., Sept. 16, 1910, (N. B. Sanson).

PYRAUSTINAE.

Genus *Phlyctaenia* Hbn.

In a recent paper (1934 Ent. Rec. XLVI p. 37 *et. seq.*) Parkinson-Curtis deals in a detailed manner with several closely allied species of the *itysalis* group; characters for differentiation are listed, one of the most important being the arrangement of cornuti in the aedeagus. On Plate VIII he gives excellent enlarged photographs showing the distinctions in this respect between *itysalis* Wlk. and *radiosalis* Moesch., our two North American species with which he is concerned in this article. According to him *itysalis* "has 5 cornuti, the first very long and strong and the other 4 becoming progressively smaller," whilst *radiosalis* "has 5 cornuti and a much dilated base and of the 5 cornuti the first is short, the next three well developed and the fifth quite strong and not very short." A study of material in the Canadian National Collection confirms more or less the above conclusions, although it might be noted that in *itysalis* the number of cornuti varies from 4-6, always, however, arranged so that the cornuti become progressively shorter; in both species, furthermore, the cornuti are more or less surrounded by a number of very fine spicules, only definitely seen in fairly strong magnifications. An apparently undescribed species has been found mixed in with our *itysalis* series but easily differentiated both on maculation and on the arrangement of cornuti in the aedeagus. This is now described as follows.

Phlyctaenia saxifragae n. sp.

Primaries with ground color a pale creamy white with little blackish sprinkling except above central area of inner margin; no obvious light brown suffusion as in *itysalis*, nor are the usual spots connected with each other and with base of wing by a diffuse dark shade. Costa very narrowly smoky brown for half its length. Base of wing with small blackish patch below costa followed by a similarly colored dot representing the commencement of the t. a. line, which is also marked on inner margin at about one-third by a similar dark dot. Orbicular a well-defined, sub-quadrate blackish patch, touching costa; reniform a similarly colored more elongate patch both much as in *itysalis* but *much more clearly defined owing to the entire lack of any obscuring suffusion*. On costa beyond reniform three equally-spaced dark dots the middle one giving rise to the t. p. line which is clearly defined, strongly but bluntly dentate, slightly rounded opposite cell and strongly bent inward below reniform. A terminal series of black dots. Fringes concolorous with wing. Secondaries dull whitish with slight smoky tinge, especially along termen, a dark dot at base of vein 2 and a still fainter one on discocellular half way to base of wing; faint dark terminal dots at end of veins. Beneath primaries pale with traces of the orbicular, reniform and postmedian line of upper side; secondaries as above with the addition of a faint curved postmedian line. On both wings a series of terminal dark dots. In the male genitalia the armature of the aedeagus consists of two short, chunky,

cornuti, placed one above the other, with one (or possibly two) other, very much smaller, immediately adjacent to the upper cornutus. Expanse of wing 21 mm.

Holotype—♂, Ucluelet, B. C., July 21, 1905, (J. W. Fraser) (bred from larva on *Saxifraga*); No. 3868 in the Canadian National Collection, Ottawa.

Allotype—♀, same data.

Paratypes—1 ♂, 2 ♀, same data.

My statement, quoted by Parkinson-Curtis (*op. cit.* p. 63), that *Saxifraga* is one of the food-plants of *itysalis* Wlk. should be deleted, as it was based on the above specimens, which I had confused with Walker's species.

For convenience of comparison I give figures of the aedeagus of both *itysalis* Wlk. and the new species, *saxifragae*.

***Polopeustis arctiella* Gibs.**

Pyla arctiella Gibson, 1920, Rep. Can. Arct. Exp. III (I) 46.

This species, described as a *Pyla*, must be transferred to *Polopeustis*. The type female is so close to Ragonot's figure of *annulatella* Zett. (1893, Mon. Phyc. Pl. XXI, fig 16) that I doubt if the name can be held even as a racial form of *annulatella*; there is a small series before me from Ft. Churchill, Man., which shows the same greyish coloration of forewing as the type and a single male from Nordegg, Alta., in which the primaries are considerably darker, due to decrease of the pale overlying scaling.

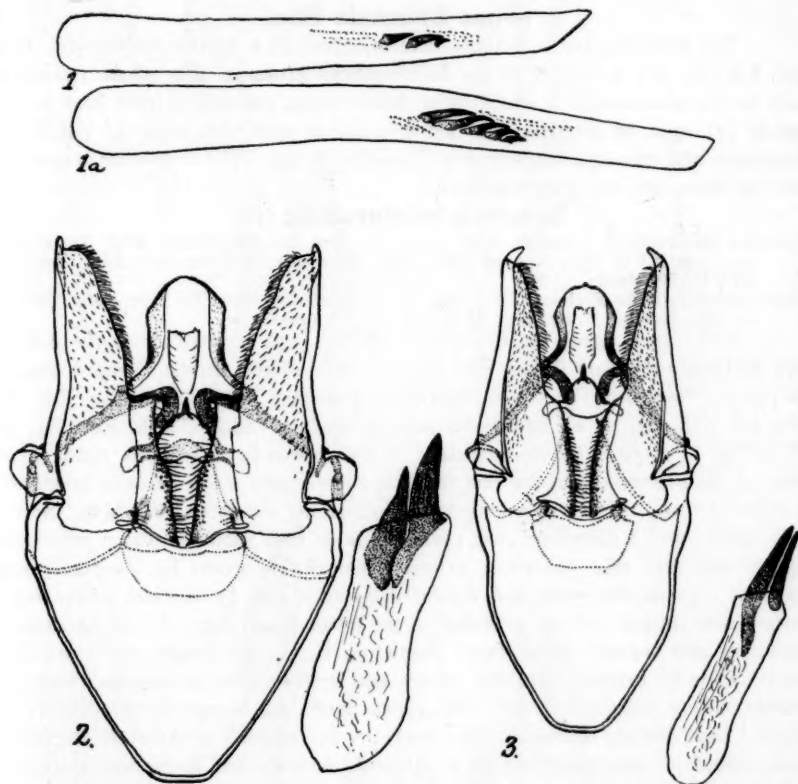
***Ambesa denticulella* Rag.**

This name, following what appears to have been an erroneous reference on the part of Ragonot (1889, Ent. Am. V, 115), has been listed in both Hulst's (1890, Trans. Am. Ent. Soc. XVII, 142) and Ragonot's (1893, Mon. Phyc. 241) monographs of the Phycitinae as a synonym of *lallatalis* Hlst., the species in both instances being placed in the genus *Ambesa* Grote. Dyar later (1904, Proc. Ent. Soc. Wash. VI, 227; 1908, *op. cit.* X, 59) after an examination of Hulst's types makes *brucei* Hlst. a synonym of *lallatalis* Hlst., stating further that the species is not an *Ambesa*, as the males possess a scale-tuft in the basal bend of the antenna. For this reason *lallatalis* was listed under *Nephopteryx* in the 1917 Check List.

Ragonot's original description of *denticulella* is as follows: "♂ 34 mill.—Fore-wings white dusted with black and slightly washed with dark brownish; lines indistinct, interrupted on dorsal fold, whitish. First line elbowed, indicated by three black spots, preceded on inner margin by a largish black patch. Second line oblique, distinctly black-margined on costa, continued by a series of long saw-like teeth.—Lower discal spot distinct." A reference to Ragonot's monograph (p. 238, and Pl. I, fig. 38) shows clearly that he *must* have been dealing with an undoubted *Ambesa* and not a *Nephopteryx* and that, *therefore*, if Dyar's statement regarding Hulst's types is to be credited, *denticulella* must be removed from the synonymy of *lallatalis* and placed in *Ambesa*.

There is before me a series of eight males and one female of an *Ambesa* from Keremeos, B. C., (June 22-July 13) which fits in excellently with Ragonot's description of *denticulella* and also well with the figure (*op. cit.* Pl. IX, fig. 3) if one makes slight allowances for inaccuracies of the artist, which occur frequently throughout these illustrations. To these I am applying Ragonot's name and would call particular attention to the large size; the three oblique

black spots, representing the upper portion of the first line; the blackish patch on inner margin; and the distinct lower discal spot, which in my specimens is almost a short dash. None of these features are mentioned by Hulst in his rather ambiguous descriptions of both *lallatalis* and *brucei*.



Aedeagus of (1) *Phlyctaenia saxifragae* n. sp.; (1a) *P. itysalis* Wlk. Male genitalia of (2) *Ambesa denticulella* Rag. (3) *A. columbiella* n. sp. Aedeagus figured separately at right.

***Ambesa columbiella* n. sp.**

Very similar to *denticulella* Rag. but smaller in size and without the contrasting maculation of this species. Primaries dull whitish, considerably dusted with black sprinkling. Maculation essentially that of *denticulella* but much less contrasting and not nearly so clearly cut, this being noticeably the case with the three spots of the antemedian line and the dentate marks indicating the postmedian line, both of which are quite obscure. Blackish discal dots present, the lower forming a slight dash, but both much less prominent than in *denticulella*. Hindwings pale smoky with white fringes. In the male genitalia there are certain slight distinctions from those of *denticulella*, viz. in the more bent in apices of the claspers, the narrower basal portion of gnathos which is connected to the tegumen somewhat differently, and the distinctly thinner cornuti of the aedeagus

(fig. 3). Expanse 27-30 mm.

Holotype—♂, Oliver, B. C., June 6 (C. B. Garrett); No. 3864 in the Canadian National Collection, Ottawa.

Allotype—♀, same data.

Paratypes—2♂, 3♀, same data.

Genus *Epischnia* Hbn.

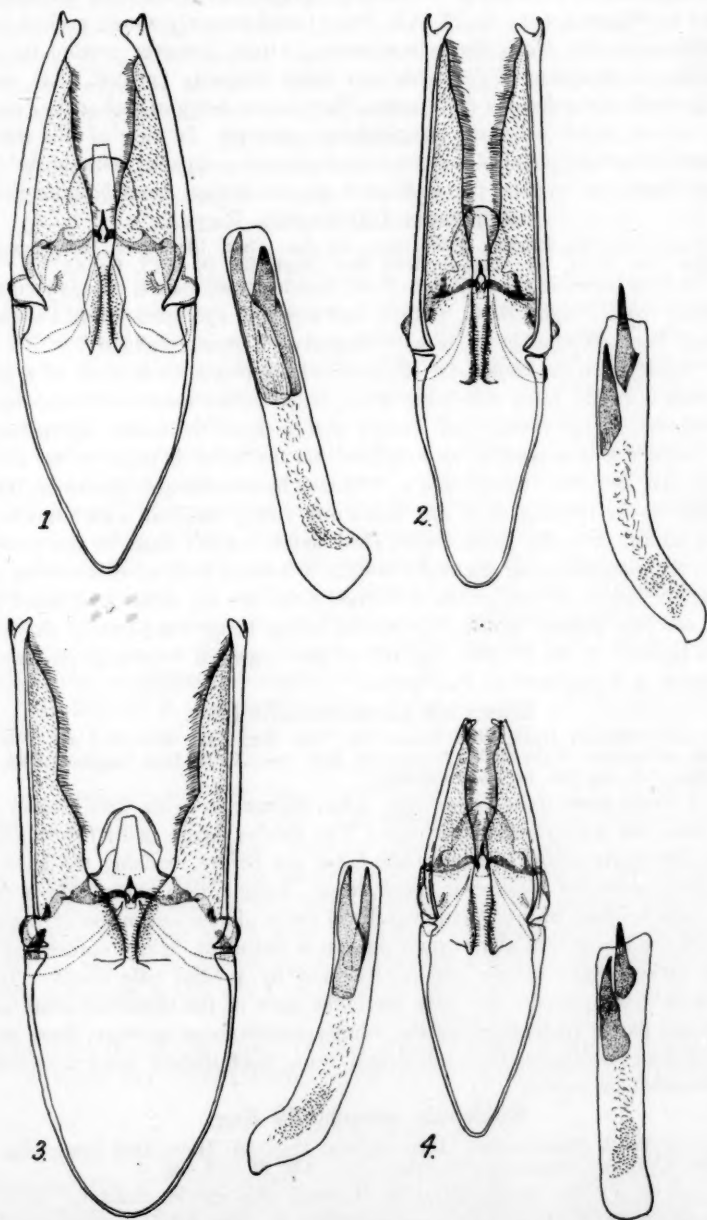
The necessity for a definite determination of a species (*vide* 1935, Can. Ent. LXVII, 70) belonging to the *boisduvaliella* group of this genus, characterized by the presence of a white stripe below costa, extending from base to (or nearly to) apex of forewing, has led to a rather extensive study of our North American and more particularly our Canadian forms. The following notes concerning these are herewith offered:—

Epischnia boisduvaliella Gn.

Epischina boisduvaliella Guenee, 1845, Ann. Soc. Ent. Fr. 318; Hulst, 1890, Trans. Am. Ent. Soc. XVII, 162; Ragonot, 1893, Mon. Phyc. 518; McDunnough, 1935, Can. Ent. LXVII, 70 (biol.).

Myelois albiplagiata Packard, 1873, Ann. N. Y. Lyc. Nat. Hist. X, 269; Hulst, 1890, *op. cit.* 164, (*partim*); Ragonot, 1893, *op. cit.* 518 (*partim*).

This name, based on European material, was omitted from the Barnes and McDunnough 1917 Check List and the name *albiplagiata* Packard used in its place. *Boisduvaliella* is well figured by Constant (1865, Ann. Soc. Ent. Fr. 189, Pl. VII, fig. 1) as *lafauryella* and by Snellen (1868, Tidsk. Ent. XI, 50, Pl. I, fig. 1) as *farrella*; characteristic of the species is the slightly ruddy fawn color of the primaries and the fact that the white costal stripe *extends completely to apex of wing*. There is a long series before me from Aweme, Man., Saskatoon, Sask., and Lethbridge, Alta., which fits in well with the above mentioned figures and also with the more extended description given by Ragonot, especially as regards *the white dot, bordered on each side by blackish above inner margin* near middle and the presence of the lower discal dot. A few Lethbridge specimens and several others from Penticton, B. C., are larger (28 mm.) and more decidedly marked than the others and might easily correspond with the Asiatic variety, *tabulella* Staud. The Nova Scotia specimens, the life-history of which I have already discussed, very evidently fall under the name *albiplagiata* Pack., based on material from New Hampshire; they are larger and decidedly paler in color than the western forms and the male claspers are somewhat longer but no other noticeable differences appear in the male genitalia, the apical end of the thickened costal portion of the clasper having practically the same characteristic shape in both forms; through the kindness of Dr. N. Banks I have received a sketch of this portion of the clasper of Packard's type in the Museum of Comparative Zoology, Cambridge, Mass., and it agrees with the above mentioned specimens; Packard's name should be retained in a racial sense, however, for the form found along the Atlantic Coast. I present a figure of the male genitalia of a Nova Scotia specimen and would again call attention to the characteristic shape of the terminal end of the costal portion of the clasper; this is slightly concave but neither the upper nor the lower edges are drawn out into decided prongs, such as we find in certain other western species; *the size and relative position* of the two cornuti in the aedeagus are also of value in separating from allied species but the first named character is the most evident one and easily observed without removing the abdomen to make a slide of the organ.



Male genitalia of (1) *Epischnia boisduvaliella* var. *albiplagiata* Pack. (2) *E. fulvirugella* Rag. (3) *E. vividella* n. sp. (4) *E. albocostalis* Hlst. Aedeagus figured at right.

Both Hulst and Ragonot treat *albiplagiata* as a good species, sinking *fosterella* Hulst as a synonym. This latter species, described from Colorado, was figured by Ragonot (*op. cit.* Pl. XX, fig. 5) and certainly shows a close general resemblance to our Nova Scotia specimens. Hulst, however erected the genus *Pima* for the reception of *fosterella* and states distinctly (*op. cit.* 164) that the male genitalia show decided differences, the claspers being *armed* at the base with *strong spines*, which is not the case with our material. In view of this statement and until Colorado material can be examined and compared with Hulst's type, it seems better to consider *fosterella* as a species distinct from *boisduvaliella*.

***Epischnia fulvirugella* Rag.**

Epischnia fulvirugella Ragonot, 1887, Diag. N. Am. Phyc. 10; Hulst, 1890, Trans. Am. Ent. Soc. XVII, 164; Ragonot, 1893, Mon. Phyc. 521, Pl. XVI, fig. 43.

A long series in the collection from Nordegg and Banff, Alta. (June); two specimens from Nicola, B. C. (May) and a single specimen from Yellowstone National Park, Wyoming, agree with Ragonot's figure excellently.

Apart from the larger size the color of the primaries is more of a greyish fawn than a ruddy fawn color; the white costal streak *does not attain the apex of primaries*, being blotted out shortly before apex by smoky suffusion; the lower discal dot is present as in *boisduvaliella* but there is only (when present) a single dark dot above inner margin, followed by considerable smoky sprinkling; the veins in the terminal area are frequently finely outlined with smoky. The male genitalia normally project backward much further than in the preceding species, the claspers being decidedly longer, a feature easy of observation under a lense; the apical portion of the thickened costa has the *upper and lower edges drawn out into distinct prongs*, the dorsal prong being considerably the longer. Hulst's figure (*op. cit.* Pl. VII, fig. 19) of the clasper of *boisduvaliella* may have been based on a specimen of this species.

***Epischnia albocostialis* Hlst.**

Ephestia albocostialis Hulst, 1886, Trans. Am. Ent. Soc. XIII, 164.

Epischnia albocostalis Hulst, 1890, Trans. Am. Ent. Soc. XVII, 163; Ragonot, 1893, Mon. Phyc. 519 (as var. of *boisduvaliella*).

A single male from Lethbridge, Alta., appears to agree with Hulst's diagnosis, based on a California specimen. The species agrees with *fulvirugella* as regards the white costal streak, which fades out before reaching the apex; the color of the primaries is however, much deeper, being a deep smoky brown, tinged basally with brighter brown; the lower discal dot is almost lost in the dark ground color and the maculation above inner margin is indistinct, being represented by a diffuse darker shade before middle, followed by a faint pale streak. In the male genitalia the claspers are quite short, the apex of the thickened costa rather narrow and partly surrounded by the thinner membranous portion; there are no strong prongs terminally, the ventral half being bent slightly inward to form a small rounded projection.

***Epischnia subcostella* Rag.**

Epischnia subcostella Ragonot, 1887, Diag. N. Am. Phyc. 10; Hulst, 1890 Trans. Am. Ent. Soc. XVII, 163; Ragonot, 1893, Mon. Phyc. 520, Pl. XX, fig. 4.

Judging by the figure given by Ragonot this species must be extremely close to *albocostialis* Hlst. as I have identified it. The original description was based on a single male from Utah and I have seen no material from this region for comparison. A female is before me from Oliver, B. C., which I tentatively

place here; it is quite similar in color to the above mentioned Lethbridge specimen but is better marked above inner margin with a small dark patch rather than a dot, followed by a slightly lunate pale streak; there is also more gray shading terminally. It is quite possible that it and the Lethbridge male are conspecific but more material is necessary, both to decide this point and to determine the correct nomenclature, as between *albocostialis* Hlst. and *subcostella* Rag.

***Epischnia vividella* n. sp.**

Differs from the preceding four species in the ruddy or pale salmon-colored forewings, shading terminally into light ochreous. The white subcostal stripe narrows considerably apically and does not quite attain apex of wing, being heavily suffused with smoky sprinkling along outer half of costa and bordered inwardly for its entire length by a narrow blackish line. The lower discal dot is present and above inner margin before middle is another, slightly larger, dark dot, followed by a small whitish spot; the marginal area basad of the dark dot is broadly and rather characteristically light ochreous, contrasting considerably with the ruddier area of the central portion of wing; outer half of inner margin beyond white spot heavily sprinkled with smoky; veins in terminal area very faintly outlined with smoky and white scaling. Fringes grayish-white, sprinkled lightly with smoky. Hindwings pale smoky, darker along outer margin with dull whitish fringe. Male genitalia with claspers long and strongly projecting backward, much as in *fulvirugella* Rag.; the apical prongs of the costa are present and subequal, but scarcely as well developed as in this species, the dorsal one being rather pointed, the ventral one broader and blunter. The cornuti in the aedeagus are more slender than in *boisduvaliella* and their apices are on the same level. The gnathos is shorter than in the other species. Both sexes very similar in color and maculation. Expanse 27-30 mm.

Holotype—♂, Lethbridge, Alta., June 18, 1922, (H. L. Seamans); No. 3862 in the Canadian National Collection, Ottawa.

Allotype—♀, same data, June 7, 1921.

Paratypes—2 ♂, same data, June 19, 25, 1922; 1 ♂, 1 ♀, Saskatoon, Sask., June 25, 26, 1923, (K. M. King); 1 ♀, Indian Head, Sask., July 4, 1924, (J. J. de Gryse); 1 ♂, Beulah, Man., June 14, 1902, (A. J. Dennis).

Apart from color this species agrees with *fulvirugella*, *albocostialis* and *subcostella*, and differs from *boisduvaliella*, in the fact that the subcostal white stripe does not quite attain apex of wing. The maculation otherwise is quite similar to that of *boisduvaliella*, differing in this respect from *fulvirugella* with which it is most closely allied on genitalic characters.

DESCRIPTIONS OF TWO NEW SPECIES OF XENOSCHESIS WITH
A KEY TO THE GENUS (HYMENOP.; ICHNEUMONIDAE)*

BY G. STUART WALLEY,
Ottawa, Ontario.

In arranging the National Collection material in *Xenoschesis*, two species were encountered which appear to be undescribed. The following descriptions are therefore presented with a table to the American species, which are all represented by specimens in the National Collection. Colour appears to be most

*Contribution from the Division of Systematic Entomology, Entomological Branch, Department of Agriculture, Ottawa.

valuable in separating our species and has therefore been used in the following key. The specimens before me exhibit only slight variation.

KEY TO SPECIES.

1. Head, thorax and abdomen tawny brown.....*nitidus* n. sp.
Head and thorax black, abdomen red or black 2
2. Abdomen red beyond apex of first tergite.....*solitarius* (Davis)
Abdominal tergites entirely black 3
3. Propodeum convex, shining, impunctate, without carinae except at apex... 4
Propodeum somewhat gibbous with fine punctures and at least traces of transverse and lateral carinae, when the carinae are not defined their position indicated by sculpture 5
4. Hind tibiae black*gracilis* Cush.
Hind tibiae white with blackish apices.....*limatus* (Cress.)
5. Hind tibiae and tarsi incrassate; hind tibiae entirely black...*crassitarsus* n. sp.
Hind tibiae and tarsi normal; hind tibiae with a broad, whitish stripe or band except at apex 6
6. Hind femora entirely black except at extreme apices...*cinctiventris* (Ashm.)
Hind femora reddish testaceous with apices narrowly blackish.....
.....*slossonae* (Cush.)

***Xenoschesis nitidus* n. sp.**

Female. Length 10 mm.; antennae 9 mm.; ovipositor scarcely exerted. Clypeus two-fifths as long as wide, broadly truncate and transversely ruguloso-punctate; face two-thirds as long as wide, rather densely punctate especially at middle; malar space about one-third basal width of mandible; eyes scarcely sinuate within, distinctly divergent below; flagellum 37 jointed; front with numerous fine punctures; vertex and temples shining, impunctate; thorax and propodeum polished, the former with fine sparse punctures, propodeum without carinae except on either side at apex; spiracle round; areolet present, petiolate, second intercubitus bent; nervellus broken below the middle; abdomen as wide as deep, polished, with only a few minute punctures on apical tergites; first tergite four-sevenths as wide at apex as long, surface rather evenly weakly convex, without dorsal ridges except at extreme base, and only a faint indication of a median furrow, spiracles located at middle of segment; second tergite as long as basal width and subequal to third, the fourth slightly shorter, the fifth almost half as long as second, the remaining tergites very much shorter; hypopygium not quite reaching apex of eighth tergite.

Pale, tawny brown; clypeus, base of mandibles, palpi, tegulae with spot before and line beneath, dull yellowish; entire front and middle legs beyond femora yellowish brown; pedicel dusky; flagellum, tips of mandibles, anterior portion of prosternum, prepectus, upper margin of mesopleura below wings, foveolate posterior margin of mesopleura, scutellar fovea, foveae at base of wings, on either side post-scutellum and basal fovea of propodeum, apical carinate margin of propodeum especially above hind coxae, blackish; wings faintly dusky, stigma and principal veins dark brownish; abdomen uniformly tawny brown.

Male. Length 9.5 mm. Resembles the female very closely. First tergite narrower throughout, half as wide at apex as long. Entire face and inner orbits

to slightly above antennae, scape below, malar space and genae narrowly below, pale yellow.

Holotype—♀, Steelhead, B. C., Aug. 14, 1933 (H. B. Leech) No. 3933 in Canadian National Collection, Ottawa, Ont.

Allotype—♂, Victoria, B. C., June 4, 1916 (R. C. Treherne).

Paratypes—♀, Steelhead, B. C., July 20, 1933 (H. B. Leech); ♀, Victoria, B. C., June 17, 1918. Paratype in the United States National Museum.

***Xenoschesis crassitarsus* n. sp.**

Female. Length 13 mm., antennae 13 mm.; ovipositor sheath equal but not surpassing apical tergite. Clypeus one-third as long as wide, broadly truncate and transversely ruguloso-punctate; face three-fifths as long as wide, densely, coarsely punctate, punctures on median elevated portion a little finer and sparser than on either side, small region on either side above clypeal fovea with punctures somewhat confused by fine rugulae; eyes sinuate within and parallel; malar space about one-fourth basal width of mandible; flagellum 43 jointed; front densely punctate; vertex and temples shining with only fine punctures bearing the vestiture; thorax and propodeum shining with numerous small punctures; propodeum somewhat gibbous with evidences of carinae but these not well defined, lateral carinae weak, distinct only toward apex, apical transverse carina absent, its position suggested by somewhat irregular sculpture, areola not defined but indicated as a slight depression; petiolarea impunctate; hind legs, especially tarsi unusually stout, hind femora three and two-thirds times as long as broad, hind basi-tarsi six times as long as greatest diameter, fourth segment of hind tarsus twice as long as broad, fifth segment rather slender; areolet present, petiolate, second intercubitus broadly curved; abdomen shallower than wide, subpolished, first two tergites very minutely shagreened, tergites beyond more polished and with sparse very minute punctures; first tergite two-thirds as broad at apex as long with two subcarinate dorsal ridges extending to about apical third, the space between with a shallow longitudinal depression, lateral margins strongly carinate between spiracle and apex with the submargins slightly impressed; second tergite distinctly longer than basal width, nearly as long as apical width, equal to length of third tergite, longer than fourth; fifth tergite four-fifths as long as fourth; sixth tergite three-fifths as long as fourth; hypopygium terminating distinctly before apex of eighth tergite.

Black, clypeus except at base brown, mandibles and flagellum pale brownish; palpi fuscous; tegulae, small dot before and below yellowish; abdominal sternites black the apices brownish black; front and middle legs and hind legs to middle of femora bright testaceous, hind legs beyond middle of femora entirely black except hind calcariae which are dark brownish; wings faintly brownish veins and stigma dark brown, the latter with a small paler brown spot at base.

Holotype—♀, Macdiarmid, Lake Nipigon, Ont., July 16, 1922 (N. K. Bigelow). No. 3932 in Canadian National Collection, Ottawa, Ont.

AN OCCURRENCE OF *TRICHOCERA GARRETTI* ALEX. AND A
LARVAL PREDATOR (DIPTERA TRICHOCERIDAE AND
COLEOPTERA, STAPHYLINIDAE.)

BY HUGH B. LEECH,
Salmon Arm, B. C.

During the winter of 1931-32, my attention was drawn to the swarms of long-legged flies in a root-house attached to the barn on my father's farm at Salmon Arm, B.C. The root-house is built above ground, with sawdust insulation between the double walls, and has three ventilation shafts through the ceiling, and one at ground level; the floor is of earth, on which planks are put down as required. At the time in question it contained a bin each of mangels and potatoes, about 200 boxes of unpacked apples, and sundry cabbages and carrots.

A few collections were made in December, 1931, and January, 1932, and a rapid increase in the numbers of flies was noted. By February 12 there were hundreds of specimens clinging to all available woodwork, while during the short periods that the root-house door was open, many of the flies found their way to the windows of the adjoining barn feedroom. A very obvious decrease in the average size of the adults was noticeable as the season advanced. A similar decrease has been cited by Saunders (5) in the case of the Chironomid *Parachanio alaskensis* Coq.

A number of larvae and a few pupae were collected from rotting areas around the crowns and broken tips of mangels, and these, with a series of adults, were sent to Dr. C. P. Alexander, who identified them as *Trichocera garretti* Alex. This species was described (1) in 1927, and the only published records of capture in British Columbia seem to be those noted in the original description: (all males); Marysville, 5500 ft., May 11, 1919, (Garrett); Cranbrook, April 5, May 5, October 21, November 9 (no year), (Garrett); Lillooet, May 3, 1916, (T. Wilson).

Marysville is near Cranbrook and both are in the Kootenay district of south-eastern British Columbia. Lillooet is on the Fraser River and near the Cascade Mountains, while Salmon Arm is somewhat intermediate and at the north end of the Okanagan Valley, in the middle southern part of the province. Dr. Alexander tells me that since the description from British Columbia material, the species has been taken in other regions in Canada and the northern United States, including Amherst, Mass.

Comstock (3) says that the larvae of *Trichocera* are "found in decaying vegetable matter, beneath dead or decaying leaves, and in fungi. They have also been found in stored roots, and tubers, especially potatoes." Imms (4) mentions fungi and decaying vegetation, while Brues and Melander (2) say "in humus soil and under leaves."

Under the relatively constant humidity and temperature conditions of a root-house, the available food supply is probably the most important single factor in limiting the increase of flies. Examinations for larvae were made on many occasions, but only between the middle of February and the end of May; in every case, larvae of all stages were present. They occurred only in the rotted portions of the vegetables, and were most common in mangels and carrots, but in-

festated such potatoes and cabbages as were available; apples were not touched. Attempts made to rear larvae on banana cultures failed, probably not because the food was unpalatable, for it could be seen in the digestive tracts of larvae which had been in the cultures for several hours, but because of the unsuitability of the spiracles to an oily substance. Gravid females died rather than oviposit in the cultures offered.

A few pupae were found in the drier parts of the rotten vegetables, but fully 90% were in the upper quarter of an inch of the soil around and below the bins. Here they were searched out and eaten by active beetle larvae. These latter ranged from top to bottom of the mangel piles, greedily feasting on all exposed and slightly buried *Trichocera* larvae. A dozen specimens were individually reared, using *T. garretti* stages only as food. Examples sent for determination to Dr. F. E. Blaisdell, Sr., were returned as *Quedius molochinus* Grav. The adults of this species fed just as readily on the fly larvae as did their progeny, and although not common in the root-house, were found in the same situations. When fully grown, each *Quedius* larva hollowed out an oval chamber in the damp sand provided; these cells did not have a lining of any kind.

My father found that by careful selection of the mangels before they were brought in from the fields, the black rot utilized by the *Trichocera* could be eliminated; hence during the winter of 1934-35, not a single specimen of the fly could be found in the roothouse, although some were seen in a root-cellar on a farm two miles away.

ACKNOWLEDGEMENTS.

I am indebted to Dr. C. P. Alexander for his determination of the flies, and for the suggestion that the capture might be worth recording; and to Dr. F. E. Blaisdell, Sr., for the identification of the beetles.

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BOOK NOTICE

"Principles of Insect Morphology," by R. E. Snodgrass. McGraw-Hill Book Company, New York, 646 pages, 319 illustrations—\$6.00.

This new book by a writer who is an authority on insect anatomy and physiology is one of the outstanding entomological books of recent years. Although titled "Principles of Insect Morphology," sufficient insect embryology and histology are included to enable the reader, even though not familiar with the subject, to understand the structure and general physiology of insects. Many

of the facts presented in this volume are to be found otherwise, only in scattered periodicals frequently not available to the worker. An especially valuable feature to the student is the glossary of terms at the end of each chapter, including as it does the German equivalent of many Greek and latin terms. There are 22 pages of references.

The author has devoted the first chapter, to linking up insects with the rest of the Arthropods and the Annelids as a background to a broader understanding of insect structure. This is followed by a chapter on the body wall and its derivatives and one on body regions, sclerites, and segmentation. Chapter V deals with the structure of the segmental appendages of the Arthropods.

The next chapter discusses the general morphology of the Arthropod head, and the structure of the insect head, with its special modifications. This is followed by a chapter on the head appendages.

Chapters VIII, IX, and X deals with the thorax and its appendages. In addition to discussing the gross structure, evolution and musculature, movement and flight are also included.

Chapter XI deals with the abdomen, its general structure, musculature and appendages.

Chapter XII deals with the mouth parts and feeding mechanism of various types of insects.

The next six chapters are devoted to the internal organization of insects. Chapter XIII deals with the alimentary canal, Chapter XIV with distribution, conservation and elimination, and Chapter XV with respiration. The next two chapters deal with the nervous system, and sense organs, and Chapter XVIII with the internal organs of reproduction. The last chapter discusses the organs of copulation and the ovipositor.

This book, written in the clear concise manner, characteristic of the author, should be a welcome addition to the entomologist's book shelf and of inestimable value as a reference or text on insect morphology.

R. H. OZBURN.

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